



## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification <sup>3</sup> : <b>G06F 3/02</b>	<b>A1</b>	(11) International Publication Number: <b>WO 83/ 03691</b> (43) International Publication Date: 27 October 1983 (27.10.83)
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(21) International Application Number: PCT/HU83/00015

(22) International Filing Date: 13 April 1983 (13.04.83)

(31) Priority Application Number: 1131/82

(32) Priority Date: 14 April 1982 (14.04.82)

(33) Priority Country: HU

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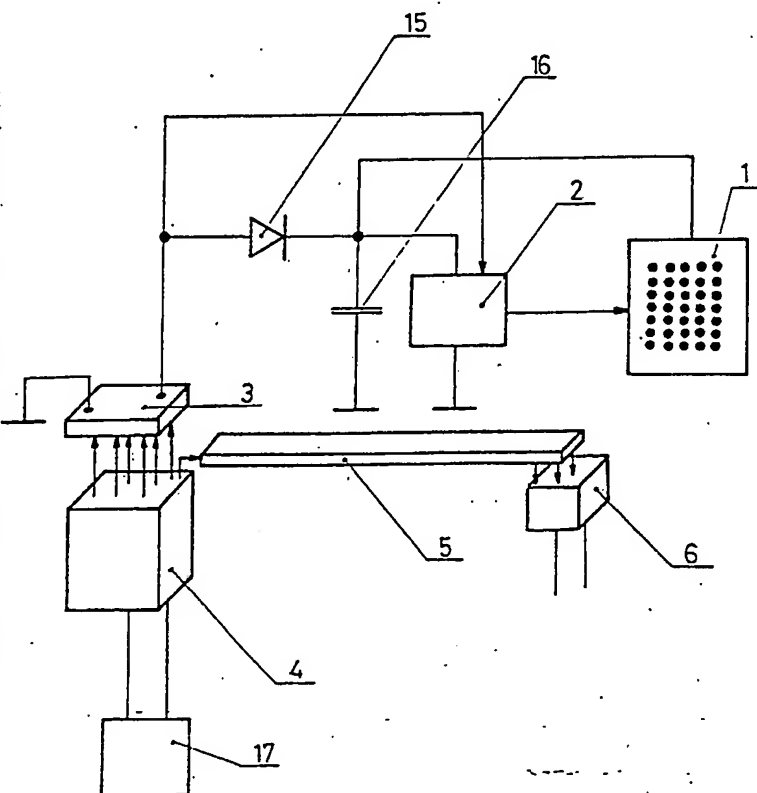
(81) Designated States: AT (European patent), AU, BE (European patent), CH (European patent), DE (European patent), DK, FR (European patent), GB (European patent), JP, LU (European patent), NL (European patent), NO, SE (European patent), US.

Published  
With international search report.

(54) Title: ELECTRIC SWITCH DEVICE WITH AN ACTUATOR KEY COMPRISING A NON-GALVANICALLY COUPLED INDICATOR DISPLAY

## (57) Abstract

An electric switch device having a fixed base body (10) and an actuator key (7) that is arranged movably relative to said base body (10). A non-galvanically coupled indicator display (1) is arranged within the actuator key (7). Within the base body (10) a radiation source (4), preferably a light emitting diode (18) is provided for, which is actuated by coded pulses, and is coupled non-galvanically with a means (3) for converting radiation into electric signals, preferably with a photocell (19) that is arranged within the actuator key (7). Output voltage generated by said photocell (19) is applied both to a rectifier and to a processor unit (2) that are both arranged within the actuator key (7). The indicator display (1), preferably liquid crystal display (LCD) is activated by the processor unit (2) while the rectifier provides supply voltage both for the processor unit (2) and for the indicator display (1). Thus, the actuator key (7) is merely non-galvanically coupled with the fixed base body (10) and a large variety of symbols such as geometric patterns, characters and the like according to coded pulses imposed may be visually displayed by using one and the same indicator display (1).



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Electric switch device with an actuator key comprising a non-galvanically coupled indicator display

Technical field

The invention relates to an electric switch device comprising a switching member arranged between a fixed base body and an actuator key that is movable relative to said base body, said actuator key containing a non-galvanically coupled indicator display.

Electric switches capable of indicating their function, their state of activation or even the necessity of being actuated on the switch itself or on a well visible part thereof displaying selected ones of a large variety of known signs or symbols such as figurative patterns or alphanumeric characters are in measuring instruments, computer peripheries, typewriters and in many other types of equipment widely in use. In some cases changeability of said signs or symbols applied on one and the same switch may also be required.

With typewriters, e. g. having interchangeable rotary heads for typing texts written in different kinds of script, such as in Latin, in Cyrillic or in Greek letters, etc. by turn, it is desirable to have a keyboard equipped with keys where the letters and characters indicated thereon are changeable in accordance with the particular rotary head which is just in use.

With computer peripheries dedicated keyboards are frequently used wherein the keyboard function is to be changed from one mode of operation to another by actuating a specific key button designed for that purpose.

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Further examples for the wide range of application are switches, push buttons and the like as frequently used in all kinds of electronic equipment and in a large number of instruments wherein it is preferred or even necessary to provide for a visual indication of their current state of activation e. g. by displaying certain symbols or inscriptions stating their particular mode of operation.

#### Background Art

Hitherto several types of indicators associated with electric switches have become well known. Light effect indication has proved to be the simplest way by using a light source for which today, mostly if not exclusively a light emitting diode (LED) is used that is arranged within the actuating member of the switch. This type of known indicators is capable of signalling two characteristic states of a switch. One of said states can be e. g. information about the switch being activated or rather about the acute necessity for the switch to be actuated soon for some particular purpose.

With one known make of rotary head typewriters of the kind as mentioned above the keyboard comprising a plurality of switches as individual keys is covered by a mask made of thin elastic sheet material, preferably rubber, said mask bearing the letters and characters in accordance with the particular rotary head fitted for typing the required kind of text. When changing the rotary head for another one for doing a different kind of script, indication change of the keys i. e. of the switches is performed by replacing the rubber sheet mask of the keyboard by



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another sheet bearing indications that belong to the new rotary head. This known mode of changing indication is not at all convenient. The thin rubber sheet mask is liable to damage. Several different masks are to be kept in store at hand. Service life of the masks is rather limited since thin rubber sheets are not resistant to ageing and to wear.

According to another well-known technique, the individual keys of a keyboard bear a plurality of indications, i. e. signs, symbols, letters and/or characters simultaneously. In one particular mode of operation of the device in question is always only a pre-selected one of the indications per key (or switch) of live relevance. Such indications are widely in use with multi-function push keys and switches of pocket and table calculators too. This type of multiple indication is associated with a number of particular drawbacks. The indication applied by printing, graving or in any other way can only be rather small in size. Another disadvantage is that the particular indication of having been pre-selected and thus, of temporary relevance must be kept and stored in mind. Thus, permanent caution and care are necessary during work in order to avoid mistakes or malfunction.

Electric switch devices having actuator keys comprising an indicator display capable of displaying a number of different symbols or signs on its visible surface without mechanical structures and component parts and having a significantly long service life together with a remarkable wear resistance have not become available so far.



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Disclosure of the Invention

An object of the present invention is to provide an electric switch device having an actuator key comprising a non-galvanically coupled indicator display capable of displaying a number of different symbols, letters, characters or of short inscripts merely electronically on one and the same display while long service life and high reliability of the switch device are maintained simultaneously.

The above and other objects have been achieved by the provision of an improved new electric switch device of the kind as mentioned and described in the introductory part of the present specification wherein the invention lies in the new switch having a radiation source within the base body and means for converting radiation into electric signals, said means being arranged within the actuator key. The radiation source is in connection with a digital signal source while an output of said means for converting radiation into electric signals is connected both, to a rectifier and to a processor unit the output of which is in turn connected to the indicator display. Supply voltage inputs of both the processor unit and the indicator display are in connection with the output of the rectifier.

In a preferred embodiment of the electric switch device according to the invention a light emitting diode (LED) is applied as radiation source while as means for converting radiation into electric signals a photocell is provided for.

Brief Description of the Drawings

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For more accurate and better understanding,  
the invention will hereinafter be more particularly  
described with reference to the attached drawings,  
in which, by way of example only and with no limiting  
5 effect to the scope of claim

Fig. 1 shows a schematic picture of a possible  
preferred embodiment of an electric switch device  
according to the invention designed by way of example  
as a slide switch with an actuator key movable in  
10 a direction that is perpendicular to the plane of  
the drawing sheet,

Fig. 2 indicates the electrical structure of  
the slide switch as shown in Fig. 1 schematically,

Fig. 3 shows a more detailed circuit diagram  
of the electrical structure of the switch device in  
15 question, and

Fig. 4 indicates pulse pattern diagrams which  
show the function and will be referred to in the  
following detailed description of the operation of  
20 the device as shown diagrammatically in Fig. 3.

#### Mode for Carrying out the Invention

A preferred embodiment of the electric switch  
device according to the invention designed and construct-  
ed as a slide switch is schematically shown in Fig. 1  
25 of the attached drawing. The switch device consists  
of a fixed base body 10 and of an actuator key 7 which  
is slidable guided in directions that are perpendicular  
to the sheet of the drawing between guide slots 8  
of the base body 10. The latter is secured to a frame  
of an equipment (not shown) the switch device in  
30 question is applied to. The switch device as shown

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in Fig. 1 is to be actuated by sliding the actuator key 7 into different positions which may be two or more in number. The base body 10 is equipped with a radiation source 4 preferably with a light source.

5 However, the radiation source 4 may be of any other kind, e. g. a source for generating electric or magnetic field instead.

10 The actuator key 7 provides for the electric contacts that are foreseen to its particular positions and it indicates simultaneously by displaying data, signs or figurative patterns that are characteristic for its current state of activation, the deed of a particular switching operation. Switching is performed by a signal transmitting member 5 arranged at the bottom part of a housing 9 of the actuator key 7, said member 15 being capable of transmitting radiation emitted by the radiation source 4. In case of light radiation, as a signal transmitting member 5 a light conductor or fibre optics known per se may be applied. For transmitting 20 magnetic radiation any soft-magnetic conductor while for that of electric radiation a simple electrical conductor can be used. At a location remote from the radiation source 4 a radiation detector 6 is secured to the base body 10.

25 Upon sliding the actuator key 7 into activated switching position the signal transmitting member 5 is moved into the near proximity of both the radiation source 4 and the radiation detector 6. Hence, a coupling is established between said component parts via 30 signal transmitting member 5, said coupling resulting in a significant change in the level of the output signal of the radiation detector 6. The change of the output signal level may be directly utilized for





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actuating an electric circuit to be switched. In case of light radiation, as radiation detector 6 a photodiode, phototransistor, photocell or a photo-resistor may equally be used. Naturally enough, any  
5 other kind of photoelectric inverter or coder may also be applied for said purpose. For indicating magnetic radiation e. g. an inductive coil or a Hall-generator while for the indication of electric field the armature of a condensator may be used.

10 Switching may also be performed and established in any other well known non-galvanic manner that will not be dealt with in detail within the present specification since these techniques are outside the scope of the present invention and are also quite obvious to  
15 those duly skilled in the art.

As already mentioned earlier, the actuator key 7 of the proposed new switching device is equipped with a non-galvanically coupled indicator display 1 which is arranged on the top surface of the housing 9,  
20 and is covered by a transparent cover plate 11. Preferably a liquid crystal display (LCD) is applied that is arranged on a support plate 12 which is secured together with the indicator display 1 and the cover plate  
25 11 to the housing 9, preferably by an adhesive seal along the edges. The assembly consisting of support plate 12, of indicator display 1 and of cover plate 11 is held in position by a flange extending over the vertical wall partitions of housing 9.

30 In the bottom part of housing 9 opposite to the radiation source 4 an aperture is provided for in which a suitable means 3 for converting radiation into electric signals is situated. When using light radiation, said means 3 for converting same into electric signals is preferably a photocell generating



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electric voltage at its output upon receiving light. Within the preferred embodiment shown in Fig. 1 said means 3 for converting radiation into electric signals and said signal transmitting member 5 are arranged and positioned relative to each other in a manner that the beam of radiation directed towards means 3 is only partially intersected and thus, screened by said transmitting member 5 allowing thereby a substantially larger quantity of the radiation energy to arrive at said means 3 and thus, to be converted into electric signals by the latter. Onto the inner surface of a bottom part of the housing 9 a base plate 13 is secured which in turn, serves as a support member both for the means 3 for converting radiation into electric signals that is secured to the lower surface of base plate 13 and for a processor unit 2 which is embedded in the upper surface of the same. Base plate 13 is provided with a wiring preferably with one of the printed circuit type, for galvanically connecting the processor unit 2 to said means 3 for converting radiation into electric signals and also for connecting processor unit 2 to the indicator display 1 via connecting wires 14.

Fig. 2 shows the electric structure of the electric switch device according to Fig. 1 in a schematic, partly axonometric manner as a block diagram. The radiation source 4 is controlled by a signal source 17 which generates preferably digital signals that are coded in accordance with the symbols, patterns and/or characters to be displayed for indicating a current function or state of the switch. The same coded signals may be used for performing the switching operation itself, as mentioned earlier. For doing so, the coded signal is led via radiation source 4 and signal transmitting member 5 to the radiation detector 6



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when the actuator key 7 is moved into its activated position. In accordance with the plurality of codes applied, by means of a decoder (not shown) that is connected to the output of the radiation detector 6,  
5 an adequate plurality of connection patterns i. e. switching states can be generated and maintained.

An output of the means 3 for converting radiation into electric signals is connected via diode 15 to a condensator 16. Diode 15 and condensator 16 together provide for a rectifier whereby at the condensator  
10 16 a rectified direct voltage pulse pattern of voltage pulses that are introduced at said output of said means 3 for converting radiation into electric signals is presented. In addition, said output of means 3 is  
15 also in connection with an input of the processor unit 2 for decoding and for activating the indicator display 1 connected thereto in a manner so as to display a symbol, sign, pattern or character that is defined by the current code that is just introduced to the  
20 radiation source 4.

The output of the rectifier, practically presented by the two armature clamps of the condensator 16, is connected to supply voltage inputs of both the processor unit 2 and the indicator display 1.  
25 Thus, energy supply both for the indicator display 1 and for the processor unit 2 is met from the energy of radiation and no separate wiring for voltage supply to said units is needed.

Fig. 3 shows a detailed circuit diagram of  
30 the structure according to Fig. 2 while operation and function of the circuit will be described in the following with additional reference to Fig. 4 indicating different pulse patterns for more detailed explanation.



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Within the embodiment of the electric switch device according to the invention as shown in Figures 3 and 4 a light emitting diode (LED) 18 is used as radiation source. Accordingly, as means for converting radiation into electric signals a photo-cell 19 is applied, the output of which is connected to a rectifier formed by the diode 15 and the condenser 16, and also to a Schmitt-trigger 20 that forms the input of the processor unit 2. The latter comprises further a monoflop 21, a shift register 22, a display driver 23 and an oscillator 24. The output of the Schmitt-trigger 20 is connected both to the input of the monoflop 21 and to the series data input of the shift register 22. An inverting output  $\bar{Q}$  of the monoflop 21 is connected to the clock input of the shift register 22.

The outputs of the shift register 22 in turn are connected to data inputs of a display driver 23 known per se, particularly of a liquid crystal display driver having an oscillator input which the output of an oscillator 24 is connected to. Outputs of the display driver 23 are, in turn, connected to the inputs of the liquid crystal type indicator display 1 in a manner known per se.

Pulse patterns shown in Fig. 4 will help to fully understand function and operation of the circuit indicated in Fig. 3. From a signal source not shown in Fig. 3, coded pulses A are introduced to the light emitting diode 18 which is emitting light pulses X accordingly. Since the rate of transmission of the light emitting diode 18 is limited, the light pulses X are slightly distorted. Arriving at photocell 19, light pulses X generate voltage pulses B while the

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pulse pattern is further distorted. At the condenser 16 a filtered D.C. voltage C will appear that is introduced as supply voltage into the Schmitt-trigger 20, the monoflop 21, the shift register 22, to the display driver 23 and also into the oscillator 24. While passing the Schmitt-trigger 20, voltage pulses B will be refreshed, and at the trigger output pulses appear that are substantially identical with coded pulses A though they are slightly delayed with respect to the latter. The monoflop 21 is activated by the descending rear edges of the pulses D, and at the inverting output Q of the monoflop 21 appear pulses E of constant duration that are introduced to the clock input of the shift register 22. Comparing pulses E and pulses D it will be apparent that data being currently given to the series data input of the shift register 22 will be introduced into the latter upon the ascending edges of pulses E. Fig. 4 shows that simultaneously with the ascending edge of the first pulse E, pulse D is at its high logical level while pulse D is at its low logical level when the ascending edge of the second pulse E appears. Hence, already decoded pulse width modulated coded pulses A will be introduced into the shift register 22, and the decoded pulse will appear at parallel outputs of the shift register 22 only, after the series code is fully introduced.

It will be apparent to experts duly skilled in the art that also embodiments of the circuit structure other than shown as a particular example in Fig. 3 may be designed and used. Depending from the coding system chosen the circuit structure may show significant alterations. It may also be of advantage to integrate at least some of the circuit



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units into one single integrated circuit (IC). The scope of the invention is not at all affected by simultaneous application of two or more light emitting diodes 18. Alternatively, instead of a single photo-  
5 cell 19, a plurality of cells connected in series may be applied in order to achieve higher voltage. For diode 15 the use of a diode of the low drop-out voltage type may be of advantage.

Lacking friction contacts, the electric  
10 switch device according to the present invention is of extremely high reliability. It can be used within a wide range of applications such as in multi-function keyboards of pocket and table calculators and the like in particular.



Claims

1. An electric switch device comprising a switching member arranged between a fixed base body and an actuator key that is movable relative to said base body, said actuator key containing a non-galvanically coupled indicator display, said electric switch device being characterized in having a radiation source (4) within said base body (10) and means (3) for converting radiation into electric signals, said means (3) being arranged within said actuator key (7), said radiation source (4) being in connection with a digital signal source (17) while an output of said means (3) for converting radiation into electric signals is connected both to a rectifier and to a processor unit (2) the output of which is connected to said indicator display (1), and supply voltage inputs of both the processor unit (2) and the indicator display (1) are connected to the output of said rectifier.

2. An electric switch device as claimed in Claim 1, characterized in having at least one light emitting diode (LED, 18) as radiation source (4) while as said means (3) for converting radiation into electric signals at least one photocell (19) is provided for.



List of Reference Signs of the Drawings

1	indicator display
2	processor unit
3	means for converting radiation into electric signals
4	radiation source
5	signal transmitting member
6	radiation detector
7	actuator key
8	guide slot
9	housing
10	base body
11	cover plate
12	support plate
13	base plate
14	connecting wire
15	diode
16	condensator
17	signal source
18	light emitting diode (LED)
19	photocell
20	Schmitt-trigger
21	monoflop
22	shift register
23	display driver
24	oscillator
A	coded pulses
B	light pulses
C	voltage pulses
D	D.C. pulses
E	pulses
X	pulses





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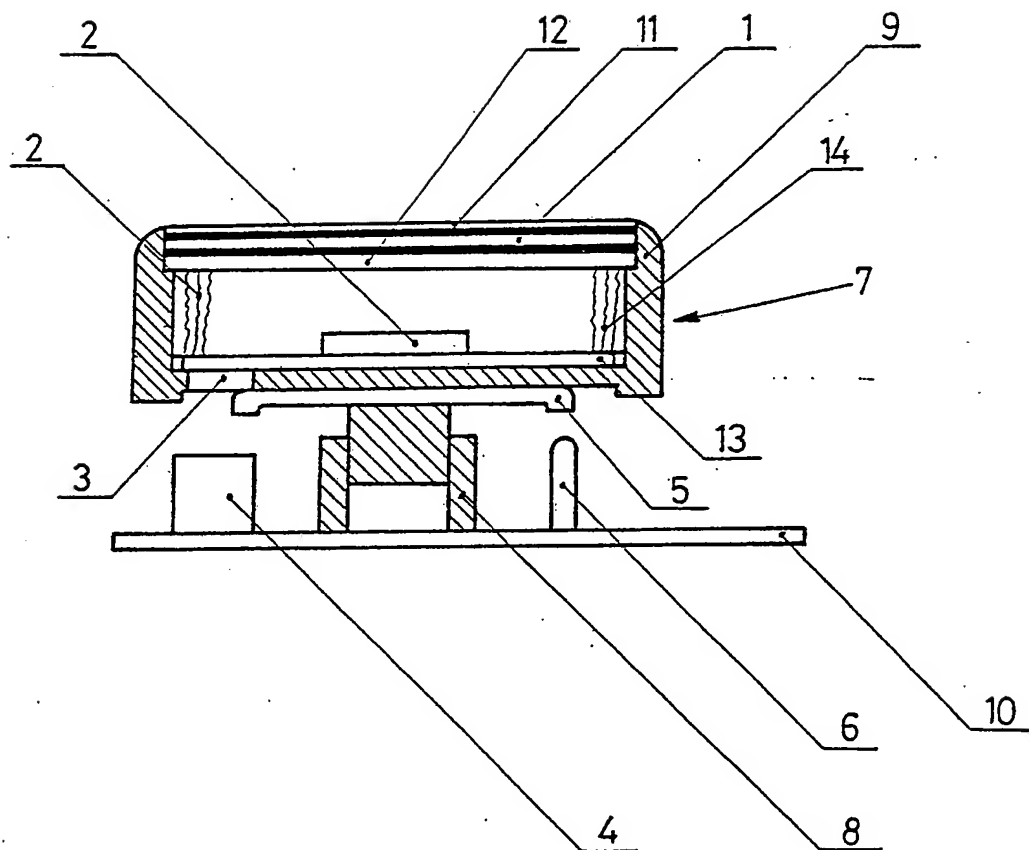


Fig.1

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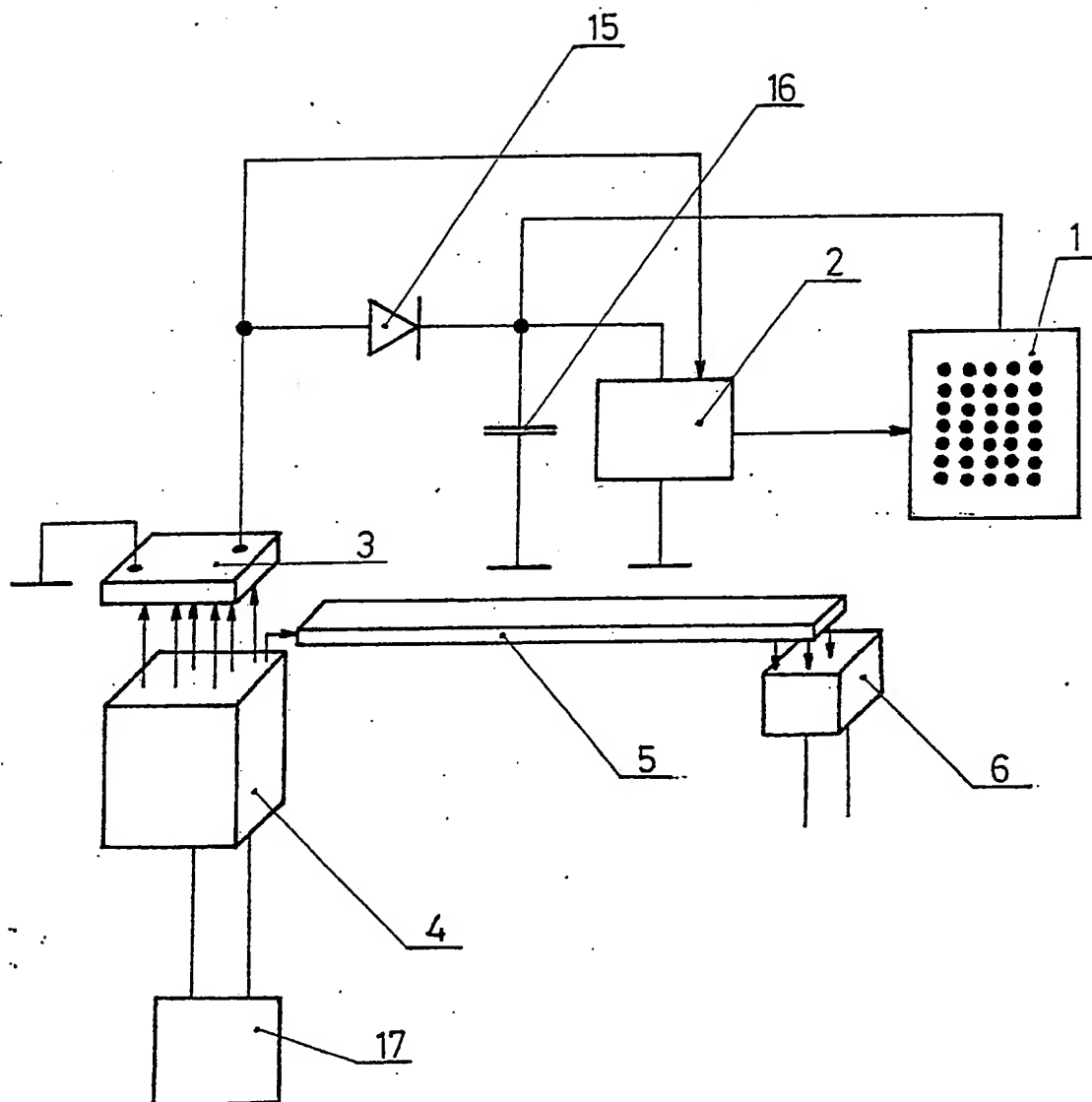


Fig. 2

3/4

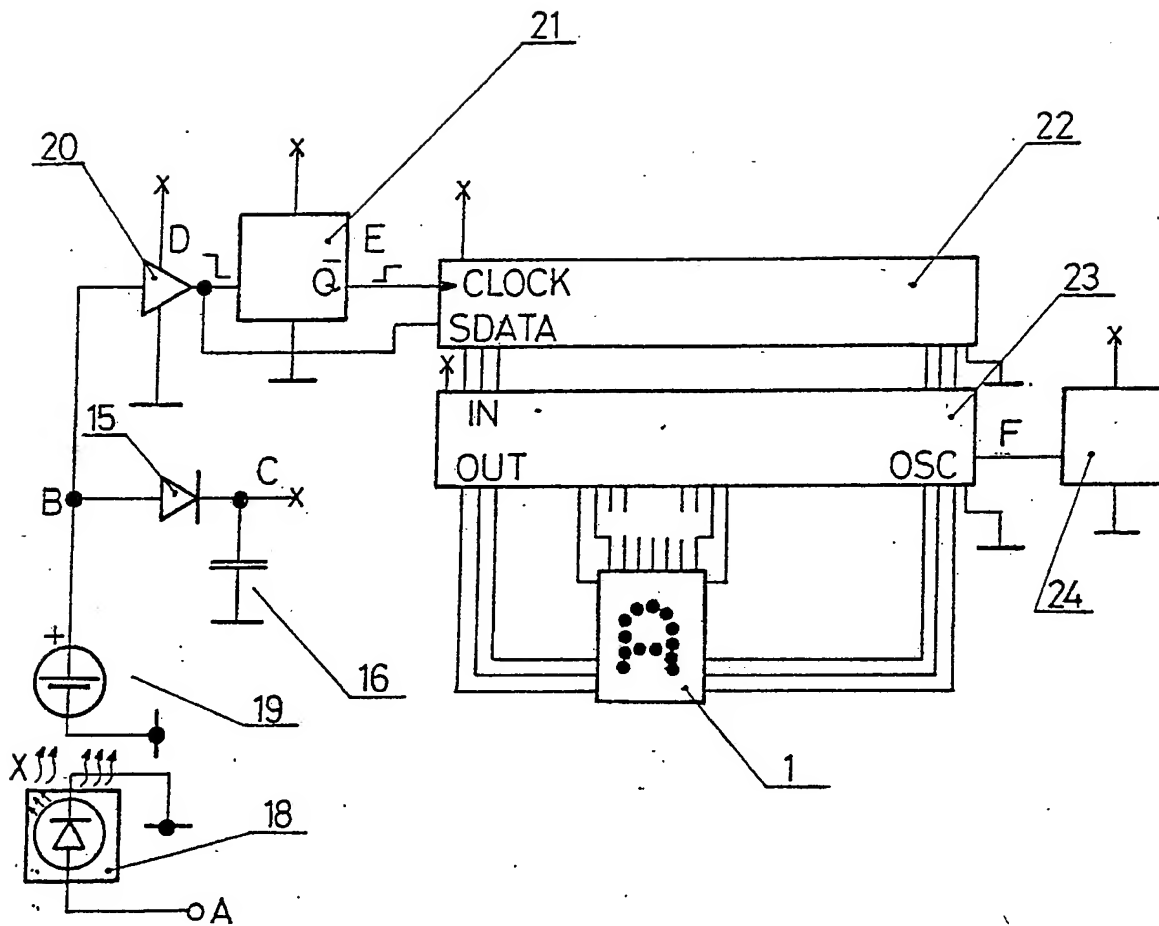


Fig. 3

4/4

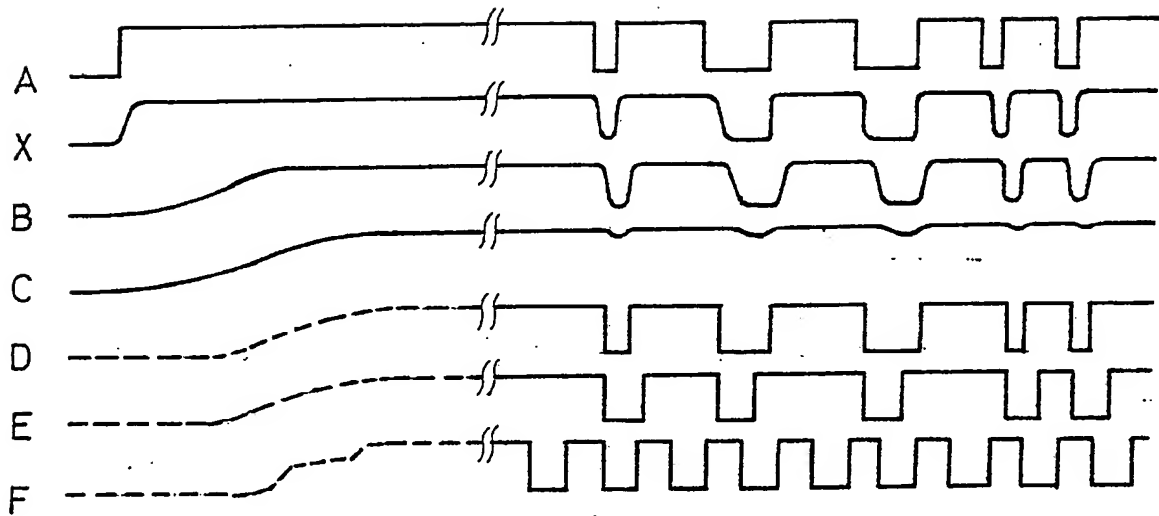


Fig. 4

# INTERNATIONAL SEARCH REPORT

International Application No PCT/HU83/00015

<b>I. CLASSIFICATION OF SUBJECT MATTER</b> (If several classification symbols apply, indicate all) <sup>1</sup> According to International Patent Classification (IPC) or to both National Classification and IPC <div style="text-align: center; font-size: 1.2em; margin-top: 10px;">G06F 3/02</div>											
<b>II. FIELDS SEARCHED</b> <div style="text-align: center; font-size: 0.8em; margin-top: 10px;">Minimum Documentation Searched <sup>4</sup></div> <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 5px;"> <tr> <td style="width: 30%; padding: 5px;">Classification System</td> <td style="padding: 5px;">Classification Symbols</td> </tr> <tr> <td style="padding: 10px; vertical-align: top;">IPC<sup>3</sup></td> <td style="padding: 10px; vertical-align: top;">G06F 3/00, 02, 023; H03K 17/18</td> </tr> </table> <div style="text-align: center; font-size: 0.8em; margin-top: 10px;">Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched <sup>5</sup></div>			Classification System	Classification Symbols	IPC <sup>3</sup>	G06F 3/00, 02, 023; H03K 17/18					
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IPC <sup>3</sup>	G06F 3/00, 02, 023; H03K 17/18										
<b>III. DOCUMENTS CONSIDERED TO BE RELEVANT</b> <sup>14</sup> <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 5px;"> <tr> <th style="width: 10%; padding: 5px;">Category <sup>6</sup></th> <th style="width: 70%; padding: 5px;">Citation of Document, <sup>15</sup> with indication, where appropriate, of the relevant passages <sup>17</sup></th> <th style="width: 20%; padding: 5px;">Relevant to Claim No. <sup>18</sup></th> </tr> <tr> <td style="text-align: center; vertical-align: top; padding: 10px;">A</td> <td style="padding: 10px;">FR, A5, 2228409 (S.A.D.A.R.) 29 November 1974 (29.11.74)</td> <td style="text-align: center; vertical-align: top; padding: 10px;">1</td> </tr> <tr> <td style="text-align: center; vertical-align: top; padding: 10px;">A</td> <td style="padding: 10px;">FR, A1, 2318460 (Master Specialties Company) 11 February 1977 (11.02.77)</td> <td style="text-align: center; vertical-align: top; padding: 10px;">1</td> </tr> </table>			Category <sup>6</sup>	Citation of Document, <sup>15</sup> with indication, where appropriate, of the relevant passages <sup>17</sup>	Relevant to Claim No. <sup>18</sup>	A	FR, A5, 2228409 (S.A.D.A.R.) 29 November 1974 (29.11.74)	1	A	FR, A1, 2318460 (Master Specialties Company) 11 February 1977 (11.02.77)	1
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A	FR, A1, 2318460 (Master Specialties Company) 11 February 1977 (11.02.77)	1									
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p><sup>*</sup> Special categories of cited documents: <sup>16</sup></p> <p><sup>"A"</sup> document defining the general state of the art which is not considered to be of particular relevance</p> <p><sup>"E"</sup> earlier document but published on or after the International filing date</p> <p><sup>"L"</sup> document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p><sup>"O"</sup> document referring to an oral disclosure, use, exhibition or other means</p> <p><sup>"P"</sup> document published prior to the international filing date but later than the priority date claimed</p> </div> <div style="width: 45%;"> <p><sup>"T"</sup> later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention.</p> <p><sup>"X"</sup> document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step.</p> <p><sup>"Y"</sup> document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p><sup>"Z"</sup> document member of the same patent family</p> </div> </div>											
<b>IV. CERTIFICATION</b> <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 5px;"> <tr> <td style="width: 50%; padding: 5px; vertical-align: top;">           Date of the Actual Completion of the International Search <sup>9</sup>  <div style="text-align: center; margin-top: 10px;">29 June 1983 (29.06.83)</div> <div style="text-align: center; margin-top: 10px;">ISA/SU</div> </td> <td style="width: 50%; padding: 5px; vertical-align: top;">           Date of Mailing of this International Search Report <sup>8</sup>  <div style="text-align: center; margin-top: 10px;">27 July 1983 (27.07.83)</div> <div style="text-align: center; margin-top: 10px;">Signature of Authorized Officer <sup>10</sup>   /V. Belov/ </div> </td> </tr> </table>			Date of the Actual Completion of the International Search <sup>9</sup> <div style="text-align: center; margin-top: 10px;">29 June 1983 (29.06.83)</div> <div style="text-align: center; margin-top: 10px;">ISA/SU</div>	Date of Mailing of this International Search Report <sup>8</sup> <div style="text-align: center; margin-top: 10px;">27 July 1983 (27.07.83)</div> <div style="text-align: center; margin-top: 10px;">Signature of Authorized Officer <sup>10</sup>   /V. Belov/ </div>							
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